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CIFRA: Challenging the ICT Patent Framework for Responsible Innovation

D3.1: Report on potential new framings, identifying needs for changing the current IPR regime relevant for ICT industries

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PREFACE

Social Sciences and Humanities (SSH) do not usually take a preeminent role in technical research projects. Sister projects arise as part of Horizon 2020 Framework Programme as a way to address this historical constraint and to allow SSH make a meaningful contribution to the shaping of the research agenda. To this regard, Sister projects are created to go beside the mainstream research in order to challenge existing biases in the research agendas and trying out more daring alternatives through the widening of imaginaries and by taking into account the SSH perspective.

CIFRA, as a Sister project, does not take the current status quo in the ICT patent ecosystem for granted, but on the contrary, explores the impact that potential new framings could have in ICT innovation and the value they could provide to the society.

Moreover, CIFRA project has addressed the ICT Patent ecosystem from the perspective of the Responsible Research and Innovation (RRI), thus with the aim of determining the way it can be better aligned with the values, needs and expectations of society.

1 INTRODUCTION

This document results from the work of the CIFRA project (Challenging the ICT Patent Framework for Responsible Innovation) and it follows and builds upon previous documents produced in the frame of that project, and namely the following. Document D2.1 “Literature Review”, reviews the literature around issues in the patent system, with a special focus on the ICT sector. In turn, document D2.2 “Empirical Evidence on ICT patents between 1990 and 2012” is the result of the analyses of patent databases over the period 1990-2012 exploring different patenting trends as well as the correlation between different factors such as measures associated with excessive patent fragmentation/proliferation and patent lags. Document 2.3 “Report on the Ethical Implications” explores the literature dealing with the ethical implications of patents in general, and patents in the ICT sector specifically.

Taking those documents as the starting point the experts involved in the CIFRA project addressed a crucial question: how to improve the current system, especially at its margin, that is, without the need to make deep changes in the system. As a result of the literature analyses carried out at an earlier stage in the project, as well as, the discussions among the members of CIFRA consortium, a set of potential levers and tweaks in the system was identified, that could alleviate some of the detected issues. These potential solutions are described in chapter 2 of this document.

Among the different intellectual property rights, the CIFRA project chose to focus on patents because patents are particularly relevant in ICT. We acknowledge upfront that findings might not be generalizable to other IPRs or industrial contexts.

Chapter 3 of this document explores the example of open source software, as well as other copyright licenses not related to software, analyzing their characteristics, how they contribute to the societal welfare and wealth and to what extent they could be extrapolated

to the patents realm. As a result, a set of requirements is described for patent licenses that would mimic the example of open source software.

2 PROPOSED SOLUTIONS TO THE FRAGMENTATION WITH A SPECIAL FOCUS ON ICT

This chapter describes different tweaks in the patent regime as well as other tools and levers that can be put in place or promoted as a way to overcome or minimize some of the issues depicted in CIFRA deliverables 2.1, 2.2 and 2.3.

These proposals are not necessarily supported by any previous academic study, nor there is factual certainty that they will be useful in terms of solving the identified issues or whether they would cause side effects. On the contrary, they have been identified by the CIFRA consortium as tools with a potential impact on the identified issues, based on the in-depth literature review as well as on the personal expertise of the consortium member experts, and taking into account the opportunity provided to H2020 Sister projects to analyze more daring alternatives and to widen the imaginaries.

The criterion to add a proposal in the set was the sustained opinion by at least a member of the CIFRA consortium that it may have a positive impact in at least one aspect of the system. Thus, the consortium has selected to have a wider set of proposals to be further evaluated by industry experts, rather than a smaller set on which there was a majority of the members positive about their potential beneficial effect, or even a consensus.

Thus, the proposed levers do not reflect the position of the CIFRA consortium as a whole nor the position of any of its member companies. Nevertheless, they are the starting point for the interviews and the survey conducted as part of CIFRA work package 3, in order to check the perception of the different stakeholders in the ICT industry about the different proposals and to what extent they are worth exploring.

The potential tweaks, tools and levers described in this chapter may be incompatible or even contradictory with each other. Moreover, it is foreseeable that different types of stakeholders tend to support different set of proposals. However, it is expected that the work conducted in the frame of CIFRA helps bring some clarity to regulators, legislators, patent offices and the different stakeholders so that a more balanced and less troublesome patent ecosystem can be reached by acting on the appropriate levers.

2.1 STRICT NOVELTY REQUIREMENT

Over the last decades, the patent offices observed how patent applications proliferated and how their scope tended to reduce. More patents were granted, but not more technology was disclosed. The Offices took it as an important task to counter that tendency by issuing programs to become stricter on certain requirements for the applicant, see for example the Raising the Bar program by the European Patent Office (EPO 2007) . They did not want, and

also could not, change the legal framework. But they could play on certain administrative rulings and internal guidelines.

That exercise was reinforced by a better understanding of the boundaries of patentable inventions, mostly for those relating to computer inventions.

Overall, we welcome those efforts and expect that they result in higher quality patents being issued. Another positive effect being that some of the cases refused at the first instances have now gone into appeal. This will possibly result in more cases being decided. The corpus of cases will be likely to extend for the system, and that fine-tuning exercise also will eventually bring quality to the system.

2.2 HIGHER FEES

On one side, fees charged by the patent offices have been the subject of much debate for decades now. To lower entry barriers for start-ups and SMEs during the early stages of their life, patent offices had the tendency to subsidize fees for filing applications, publications and searches of prior art. Subsidies would largely mean that the cost of conducting that work would not be recouped by the fees imposed on those services. The equation would be balanced by considering the amount that other applicants and patent proprietors would need to pay in renewal fees.

Recent trends of holding patent rights for shorter periods made that system become unstable. The reaction was in some cases to lower working times and improve efficiency to try not to subsidize too many products and services offered by the patent offices. Alongside, a push to more harmonization among patent offices may be driving some of those costs down or at least keeping them at bay. The debate is still ongoing as to what kind of system would be preferred, and whether higher fees would, in fact, be needed.

On the other side, the main hurdle for the applicant of a patent remains at the billing hours of the patent attorneys. They usually add a margin on all their actions, as any other business would do. That puts extra pressure on the fees from patent offices to remain at low levels.

In the framework of the present study, we advocate that the higher fees should come at the end of the patent life, even more strongly than currently, and in the form of higher renewal fees. Companies should be incentivized to implement or license their inventions. Indeed, achieving technological progress is one of the main drivers for the patent system, and that progress necessarily means implementing the technology into products and services that benefit our society. Thus, higher fees would de-incentivize (the stick model) keeping rights for dubious technology, at least for too long time.

The advantage of higher fees has another angle. In some patent regimes, the offering of a widespread license to any third party results in lowered renewal fees. That saving is the positive incentive (the carrot), for the inventors to not give up the filing of a patent and at the same time to offer a wider license. This way the invention can find an easier way into becoming implemented in products and practiced by companies, what is perceived as a positive aspect for the society at large.

2.3 ADDITIONAL SUPPORT FOR SMES (FURTHER REDUCTION OF FEES, SUBSIDIES)

As previously explained, increasing the different patent prosecution and maintenance fees can be a useful lever to avoid the proliferations of low-quality patents or to shorten the effective protection duration over inventions. However, increasing the fees may have side effects, especially with regards to small entities (e.g. SMEs, start-ups), which could end up not being financially able to protect their inventions.

In order to facilitate the protection of the inventions of small entities, two main types of measures can be put in place: reduction of fees and subsidies. The former type has already been put in place by many patent offices. For instance, the European Patent Office (EPO) grants a 30% reduction in filing and examination fees for small and medium-sized enterprises, individuals, non-profit organizations, universities or public research organizations. The EPO understands by SME those companies with fewer than 250 employees, an annual turnover not exceeding EUR 50 million and an annual balance sheet not exceeding EUR 43 million and for which no more than 25% of the capital is held directly or indirectly by another company that is not an SME.

A measure of SMEs purely based on the number of employees may be misleading, as SMEs with just a few employees may have extremely high revenues. Therefore, these mixed criteria by the EPO point at the right direction. However, a further categorization of SMEs may be carried out based on the two factors, and different actions may be targeted to each category. Subsidies to small entities are also a common practice. For instance, the Spanish government regularly issues subsidies to foster the protection of inventions by means of patents by SMEs and another type of entities, of up to 90% of the fees and translation costs in the case of SMEs and individuals. The German government grants voucher to companies applying for patents for the first time.

The fact is that, even with existing reduced fees, and subsidies the costs associated with patents are a crucial factor for SMEs in their decision on whether to patent inventions or not. Therefore, it is worth considering whether additional reductions and/or subsidies or more granular ones, depending on the actual company size, could be beneficial.

2.4 REQUIRING A MINIMUM LEVEL OF IMPLEMENTATION OF INVENTIONS AS PRE-REQUISITE TO GRANT

Most of the patent offices around the world require that the patent application contains enough information to allow an expert in the relevant field to understand and replicate the invention. Otherwise, a patent examiner may object to granting exclusive rights based on an insufficient disclosure of the invention. Indeed, easy examples of refusals would include alleged invention claims on cancer curing compositions or equipment based on superconducting materials that are not yet scientifically or technically available off-the-shelf.

The cases are not always easy to spot, and a comprehensive appraisal of the invention needs to be made at the very early stage of examining a patent application. In most of the

cases, this analysis happens some years before the resulting technology gains commercial interest, and thus there is an incentive for the inventor to implement the technology.

Typically, it is easier to scrutinize the claims of such early patents when firms compete neck-to-neck like in the case of a duopolistic industry. Indeed, if two players dominate the market and technology is a key driver, those two parties will be likely to oppose one another's inventions. As those companies are knowledgeable of the technical merits and limitations of certain solutions, they could easily spot a lack of features leading to a defective implementation of the invention. That competitor could thus comment, file arguments, oppose or even intervene in the patent proceedings. As a result, only high-quality patents would be allowed to be issued or granted.

Nowadays, that duopolistic situation is rather a rarity. Thus, without the close scrutiny of competitors, objections by patent examiners tend to focus on the difference of the invention over the found or revealed prior art.

Unless the examiners arm themselves with convincing evidence, they cannot revert the onus of the proof to the patent applicants. This only happens in limited fields of technology. For instance, active principles of chemical and pharmaceutical compounds may require the submission of experimental data.

In former times, small mechanical prototypes were required to exemplify and demonstrate the main features and effects of every invention. The requirement fitted well with the workings of small or medium-sized mechanical contraptions for the agricultural mechanization that took part in the nineteenth century. This requirement was gradually replaced by the fiction of a plausible implementation, mostly based on evidence that it needed only proof that some effect was likely to happen, and that level of likelihood was sufficient in 50% of the cases.

Inventions were allowed to be defined in abstract terms of excruciating complexity. In many instances, the used obscure or blurred terminology would even result in descriptions unknown to the most knowledgeable person skilled in the relevant field. And so, the level of abstraction raised so much, those vague ideas became patents eligible without anyone noticing. Patent proliferation resulted, and also legal certainty suffered.

Thus, a lesser proliferation of speculative patenting could be by-product of stringer requirements concerning disclosing implementation examples in the patent documentation. Indeed, if the sufficiency of the disclosure would thoroughly be examined during early stages, patents would tend to include more technical information.

Without advocating going back in time, the leap forward may need that more attention is given to implementations. The technical level of patent documentation would not only improve to provide more legal certainty; it would also become a preferred source of technical information for those really wanting to implement the invention. Technology copycats would immediately know that a license for a certain technology was needed, as the reading of implementation cases would come alongside the reading of well-defined exclusive rights.

An example of the adoption of this kind of measure is the Australian Intellectual Property Laws Amendment Act 2012 which requires, from April 2013, to disclose a specific, substantial and credible use for the invention in the patent specification.

It should be taken into account that this kind of measure would require additional costs and effort for the entity owning the invention and thus make access to patents even more difficult for small cash-constrained firms or individual inventors.

2.5 REDUCING PATENT SCOPE

The scope of a patent has not received a lot of attention by legislators. It has deserved some research by academics. However, in the empirical literature on patents, sometimes the scope of the patent is measured through the number of claims, which is perceived as a too simplistic measure.

In general, the patent scope has been seen as a tool at the disposal of patent examiners or judges when trying to ascertain the limits or boundaries of specific inventions, as defined by their claims. For instance, if a certain effect was claimed for a range of variables, say that effect would happen for a certain gas under a combination or ranges temperature, pressure and volume parameters, the examiner would not raise an objection without hard evidence that a part of those ranges would not have the desired effect. Again, the burden of proof rests primarily on the patent examiner.

All those cases and the legal principles attached to them would only trickle into slow emanating jurisprudence. Time spans counted in decades could be envisaged, if individual cases needed to multiply and be collected as case trends, and that all to generate interest and attention from those drafting guidelines at the patent offices. This juridical system has proven itself not to be suited for the faster technology cycles found in certain industry fields nowadays.

It is up to the legislation to establish new ways, where new cycles would need faster tracks, but also an increased legal certain for implementers of technology. In establishing that the burden of proof for every use case or every useful embodiment rests on the applicant or patent proprietor, there would be a renewed interest to file experimental data alongside the patent.

It would be interesting to see whether the boundaries of the invention can be defined, not by words or linguistic terms on claims, but also by graphs or experimental data. Those graphs, with temperatures, pressures and volume of certain gases, would define the ranges and so contain well-defined and restrictive boundaries.

2.6 REDUCING PATENT LIFETIME

At this moment, the maximum duration of the patent rights is fixed and non-dependent on the type of technology or any other aspect. However, it may be that one-size-fits-all is not the optimum approach, and a more flexible scheme can have some advantages for certain sectors.

In the specific case of the ICT sector, the pace of technological progress is so fast, the product lifecycles are so short and the technologies so interlaced and interdependent, that 20 years' monopolies may be seen as a threat to subsequent innovation rather than an incentive, especially when patent holder decides to keep the monopoly over the invention.

In these cases, changing one parameter in the equation, be it forcing the patent holders to license their patents (License of Right) or shortening the patent protection term, could be beneficial in terms of fostering innovation. Intermediate approaches could also be perfectly valid options, for instance, patents with a term of 20 years but with exclusion rights just in the first 'x' years, e.g. 8 years.

An issue that complicates a scheme with reduced patent lifetime is the fact that patent rights can start to be fully enforced just once the patent is granted, what usually takes a significant time. That becomes a more relevant problem, if the patent lifetime were to be reduced, as the effective period of the patent term would decrease significantly and would eventually represent just a small share of the overall term. Therefore, such a scheme would be fully useful just if the patent examination were accelerated to ensure patent owners have a minimum guaranteed effective protection period.

2.7 Dual IP Regime

Back in 2007, the EPO's report, Scenarios for the Future (EPO, 2007), envisaged four potential scenarios for the evolution of the society and, as a result, of the patent system. One of these scenarios, the "Blue Skies", described the situation where innovation pace in ICT sector is continuously accelerating and becoming more and more cumulative. Under this assumption, an ICT patent landscape with growing tensions was depicted, as opposed to a well-functioning system in other sectors such as the pharmaceutical, what lead to considering a bifurcation of the patent system, in order to adapt to the needs and characteristics of different sectors.

In fact, technologies in ICT sector may require wider technology diffusion and more collaborative innovation whilst avoiding issues such as patent thickets. The complexity and overlap of certain technologies prevent from exploiting them individually and requires instead having the right over a set of different inventions in order to be able to effectively exploit them.

In order to overcome this issue, certain tools are available around the patent system, but not as an integral part of it. For instance, the IPR policies of most SDOs (Standard Development Organization) bind their members to compulsory licensing of Standard Essential Patents on FRAND (Fair Reasonable and Non-Discriminatory) terms as a way to ensure that the standard can be effectively implemented.

The question arises on whether this kind of models can be implemented as part of the patent system, i.e. as part of the patent laws, so that it can be applied to a wider set of technologies, that is not just to standardized technologies, and without the need of external and heterogeneous tools such as SDO's IPR policies.

As depicted in Scenarios for the Future (EPO, 2007), a dual IP regime could combine the regular regime with a softer IP regime under which patent holders would no longer be able to block the use of a technology, but instead, they would be obliged to license it under specific conditions.

The regime applicable to each invention could be mandatorily determined by the technological area of the invention or, preferably, could be a matter of choice by the applicant. In the latter case, some levers would be needed in order to compel the applicants to give up some of their rights, such as the exclusion right. These levers either could be longer validity periods for soft patents or reduced fees throughout the patent lifetime.

As of 2017, we can certainly admit that the society has evolved in many aspects towards the "Blue Skies" scenario over the last ten years, therefore it is worth considering the solutions hinted in that report, as potential solutions to tensions in the system.

2.8 Enhancing Patent Pledges

The level of complexity of ICT products and services usually requires licenses over a myriad of Intellectual Property assets from a huge number of companies. Only if there is a willingness to license the patents associated with this type of complex products and services by the different players, they can be effectively produced.

One of the most amazing examples of collaborative innovation ever happened are mobile networks, in whose development has collaborated a large number of companies and in which manufacturing, deployment and exploitation take part an even larger number of companies across the different parts of the value chain. All these actors make the provision of a service possible, which already benefits 5 billion subscribers[1]. This has been possible thanks to two complementary mechanisms: standardization and patents. Standardization allows different entities to discuss about the different technological proposal and choose the most suitable ones, which become part of the standard and are meant to be used by the whole industry. On the other hand, patents are the tool that allows companies to share their innovations, with the conviction that they will not be used without rewarding the patent owners for their investment in innovation. Allowing to combine both mechanisms and to make the standard effectively implementable, the IPR policies of SDOs (Standard Development Organization) bind their members to license essential patents, that is, those that read on the standard. SDOs' IPR policies are probably the most successful patent pledges at this moment, understanding by patent pledge a voluntary limitation of some of the rights linked to a patent.

There is though some room for improvement of IPR management in standardization. In addition, there is an opportunity to extend the example of SDOs to patent pledges in other fields beyond standards, as well as to make patent pledges more formal and reliable. These points are tackled in the following subsections.

[1] Figure reached in June 2017 according to the GSMA: https://www.gsma.com/newsroom/blog/mobile-industry-celebrates-5-billion-subscriber-milestone/

2.8.1 Enhancing IPR Management in Standardization

Even being quite successful, the management of IPRs in SDOs mainly by means of the SDOs' IPR policies has some room for improvement.

Two relevant areas of improvement are transparency and reliability. On one hand, potential licensees need to have as much information as possible regarding the patents that need to be licensed in order to implement the standard. For instance, it is advisable that owners of Standard Essential Patents (SEPs) explicitly disclose essential patents, indicating to which parts or features of the standard are essential, and whether those features of the standard are mandatory or optional. In addition, it is recommended that SEP owners update this information as the patents evolve throughout patent prosecution and as the standard further develops. For instance, patent applications that are essential at the time of declaration may not be essential later on, as the scope of the patent may change during prosecution and/or due to the standard changing during the standard development process. If the declarations of essential patents are not updated accordingly upon this kind of events, they may not be fully reliable.

All these previous facts may lead to over-declaration, that is, more patents are declared than those that are effectively essential, what may mislead the prospective licensee.

Another fact is that declarations are made by the SEP owners in good faith but, in general, SDOs do not have an independent process to check the actual essentiality of declared patents. Due to the inherent costs of independent essentiality checks, SDOs do not put in place such processes. As providing comprehensive claim charts would be a burden on SEP holders, SDOs face opposition upon considering requesting them to declarants. However, it is advisable to look for compromises that do not imply a heavy burden on SDOs or SEP holders, whilst providing information as accurate and reliable as possible to prospective licensees.

2.8.2 Enhancing Patent Pledges

In addition to the previously described commitments by SDO members, other companies and organizations make pledges, self-imposing certain limitations to the exercise of the rights granted by their patents. Patent pledges may have different forms and can be done for diverse reasons and purposes (Contreras 2015, Contreras 2017), but we could say that a common denominator is the intent to promote a collaborative ecosystem, and minimize litigation, what sometimes may be a side effect of the strategic or commercial goals of the pledging entity.

However, as pointed out by Chien (2015) the patent system does not provide universal procedures to waive some of the rights granted by patents. In addition, there is no confidence in the industry about the reliability of such commitments. This may be due to a variety of reasons, which should be tackled in order to make patent pledges a widely accepted practice.

On one hand, patent pledges should be homogenized into a reduced set of well-known and proofed licenses. The equivalent to patent pledges in the realm of the software's copyright is the Open Source Software (OSS) licenses. In that case, the Open Source Initiative (OSI),

has defined some criteria that an open source license should comply with in order to be qualified as such[2]. Moreover, OSI has a license review process that allows certifying that a proposed open source license complies with the principles. The list of approved licenses is published in OSI's web page[3]. Despite the list being quite extensive, it is worth mentioning that just a reduced set thereof accounts for an overwhelming majority of the licenses used in practice. This causes that those licenses have already been extensively used and proofed by the industry, and thus are reliable enough. This virtuous circle is missing for the patent equivalent. In fact, there is neither a well-recognized entity providing formal definition and categorization of patent pledges nor the patent offices offering flexible tools to accommodate the requirements of the industry, providing at most the option to declare the willingness to license a patent (License-of-Right). Thus, the industry lacks some well-known and proofed patent pledge licenses or contracts, which are reliable for both, those companies that voluntarily wish to waive some rights, and those companies willing to rely on the vows of the pledging company and need to be sure that they are legally binding.

Another problem is the absence of a register in which to record the pledges, with exception of the License-of-Right stored in the patent record by some patent offices. In the OSS equivalent, the pledge (license) is bound to the asset itself, as it is usually included in the header of each source code file and/or in a separate license file distributed together with the source code. In order to record patent pledges and provide some certainty that they are cast in stone, a suitable patent pledges register should be established. The most recommended approach would be to register the pledges at the patent offices themselves (e.g. as part of the patent record), but other sorts of official registers could be considered.

2.9 Enhancing Patent Pools

Patent owners think of themselves as owners of technology solutions. This is, in most of the times, not the case. Some owners have part of solutions, but others own alternatives or have other complementary pieces of technologies. A blocking situation is in many instances avoided by arriving at cross-licensing deals. However, direct negotiations are impractical when technology is fragmented and partially owned by hundreds, if not thousands. Patent owners have then, traditionally organized themselves in patent pools, especially when standard-related technology needed to be massively licensed internationally.

Patent pools have internal organization rulings that seem to vary for every program. The effort and time for their formation are very high, and reaching consensus or unanimity has been a formidable obstacle that has grinded programs to a halt, either by a lack of consensus or by attrition between licensors and would-be licensee's discussions.

A better system for managing expectations or over-expectations by many small owners or partial solutions would be welcome.

[2] https://opensource.org/osd
[3] https://opensource.org/licenses/

On the other hand, incentives to IP owners to join a patent pool are known, but not so much for those to-be licensees that would take the courage to be among the first parties to pay license fees. A transparent system of incentivizing licensees and ex-ante discussions with pool administrators could break that spell for the first-mover licensee. It would be desirable to let licensees take a pro-active role, while still keep them under a certain form of stealth needed not to attack unwanted attention as a target for litigation.

2.10 CLEARING HOUSES

Clearing house models might be another approach to facilitate access when many patents are present. The term 'clearing house' has its origin in the banking sector. It refers to the mechanism by which cheques and bills are exchanged among banks being members of clearing houses to transfer only the net balances in cash.

Meanwhile, the concept has received a more general meaning that refers to mechanisms by which suppliers of goods, services or information and their customers are matched.

In the context of patents, clearing houses facilitate the access to patented innovations by centralizing scattered patent rights. Van Overwalle (2017) distinguishes four models of clearing houses according to their functions. Two models provide access to patented or otherwise protected information. On the one hand, an information clearing house provides tools for exchanging technical information including IPR related insights. Examples include public accessible patent search sites provided by patent offices or commercially operated search tools. On the other hand, technology exchange clearing houses are platforms providing information services that display the available technologies to allow technology owners and buyers to initiate licensing or transfer negotiations. Complementary, more comprehensive mediating and managing facilities might be offered. It has to be pointed out that the negotiations related to the displayed technologies have to be conducted with the specific patent holders and not with the technology exchange clearing house. Such models are not very expensive but are challenged by achieving critical masses of patents needed to make such platforms successful. The other two more elaborate models provide not only access to the patented inventions, but also standardize their use. The standardized licenses clearing houses offer standardized licenses including various options depending on the specific features of the rights, like the type of customer, the objective of the use and the characteristics of the final products implementing the licensed technologies. Portals guiding both licensors and licensees might even generate customized licensing contracts, which are reducing transaction costs for both sides. Creative Commons is an example for a standardized license clearing house focusing on copyright-protected content, such as music, movies or books. However, Science Commons trying to replicate the copyright-focused approach of Creative Commons for patented technologies was not so successful. Finally, the royalty collection clearing house integrates all functions of the previously introduced three models plus a mechanism to collect license fees from users on behalf of the patent owners in return for the access to and use of the inventions. The patent holder is reimbursed by the clearing house management, which sometimes also manage patent pools, according to a set allocation formula, which has been negotiated beforehand. Classical examples of royalty

collection clearing houses include copyright societies such as the American Society of Composers, Authors and Publishers or other national agencies.

Overall, the principle of clearing houses has been successfully applied in the life sciences. Successful examples in ICT area are still missing. Although some clearing houses in the area of biotechnology are administrated by established patent pool managements. Regulations for PAEs

Patent assertion entities (PAEs) are entities whose business model is based on purchasing patents and asserting them to generate revenue rather than implementing and further exploiting the patented technology.

PAEs play a certain a role in the ICT patent ecosystem by allowing the exploitation of patents from small entities that would otherwise not be financially able to enter into litigation. Nevertheless, they have a dubious reputation due to the disturbing effect that their aggressive litigation and their usually excessive licensing demands have on practicing entities and final users.

PAEs are a specific type of non-practicing entity (NPE), that is, an entity that does not make or sell products and thus is immune to countersuits for patent infringement. Other types of NPEs are for instance universities, research centers, semiconductor design companies or even individual inventors. The main difference between PAEs and other types of NPEs can be therefore based on NPEs R&D investment, or in another way, whether their patents are the result of their innovation or in the case of PAEs of a sheer asset acquisition. This difference may be used as a way to develop any type of regulation that is targeted specifically to PAEs.

Regulation about PAEs, and in general about patent litigation, should definitely take into account the interest of the society as a whole, and for instance the interruption of public services (e.g. telephony or utilities) should be prevented, and instead alternative ways to ensure that intellectual property rights are respected should be sought and put in place. In general, the appropriateness of injunctive relief should be assessed on a case-by-case basis, taking into account the public interest and the existence of other levers to make intellectual property respected.

2.11 Making SDOs IPR policies (FRAND) compatible with Open Source licensing models

Standardization and open source projects represent two types of collaboration activities between different companies and individuals in order to build a technology or product, without the need of a direct commercial agreement between them. In general, different business models can be built around these two frameworks.

In the case of standards developed under FRAND policies, the standardization process implies an associated technology market in which entities contributing their patented technology to the standard receive a fair reward for their innovation investment.

In the case of standards developed under royalty free policies, as well as open source projects under licenses with patent clauses, the situation is completely different. Namely, the entities contributing to the standard or OSS project do not expect a direct reward for their contribution. Instead, they usually expect that the standard or the project will create an ecosystem from which they would benefit in some way like, for instance, providing professional services or by means of adjacent products.

However, the trend to "softwarization" of a widening range of technologies, especially in the ICT sector produces a closer dependency between standards and software. This trend is causing a closer interaction between SDOs and OSS projects, in order to benefit from potential synergies between both worlds. In fact, having the two processes, standard and OSS reference implementation, running in parallel can yield many benefits. For instance, an early implementation of a draft standard can help to detect bugs, to prove the validity of a specification or simply to accelerate the time-to-market for standardized technology.

Nevertheless, conflicts may arise because of the contrasting business models and policies in both worlds. For instance, companies owning many standard essential patents may be excluded from contributing to associated OSS projects, as it would imply granting a RF license over their essential patents, thus losing the way to get a return on their innovation. On the other hand, companies contributing to the OSS projects may not be bound by the commitments of the SDO IPR policy, if they are not members of the SDO or are not participating in the corresponding working group. This fact may create some risks when updating the standard as result of the feedback from the OSS implementation, as contributions may not be bound by FRAND commitments and implementations other than the OSS reference implementations may be theoretically blocked.

Therefore, it would be advisable to define a framework in which a close collaboration between standardization and OSS is possible, benefiting from the synergies of both worlds whilst solving the two previously mentioned problems. Firstly allowing for different business models by the different types of stakeholders and secondly providing certainty to the implementers that there is no risk to be blocked by any company contributing to the ecosystem as long as the implementer is willing to take the corresponding licenses on FRAND terms, whenever needed.

This may be possible by adapting the IPR policies and procedures of SDOs to allow for a closer collaboration with OSS, which may be even run under the umbrella of the SDO itself. ETSI is working along these lines, and in fact, a specific working group, the ETSI Board OSS, is working to define this framework.

2.12 Alternative Dispute resolution

Mediation, arbitration and expert determination are the most common types of alternative dispute resolution mechanisms that parties may use to settle IP disputes instead of resorting to litigation.

In general, the use of any of these mechanisms is consensual, that is, can only happen if both parties agree either when the dispute arises or in a contract signed prior to the conflict. Alternative dispute resolution mechanisms have advantages[4] and disadvantages, and its suitability depends on multiple factors, but in general, they are perceived as less troublesome and traumatic than litigation.

One of the key problems in the ICT patent ecosystem is the difficulty to match the supply and demand for each and every pair of IP owner and IP user. This problem is linked to the complexity of the system, with a large number of patent owners and a huge number of IP consuming companies. Although patent pools help to simplify this process, they do not solve it entirely. In fact, both patent "hold-up" and "hold-out" behaviors are to be observed. Patent "hold-up" occurs when a patent holder asks for disproportionate royalties to a user of the patent that is in a vulnerable situation, e.g. has already implemented a standard relying on the FRAND commitment of patent holders. On the contrary, patent "hold-out" occurs when a company routinely ignores patent licensing demands by patent owners (Chien, 2014).

In such a complex and globalized ecosystem alternative dispute resolution mechanisms can be helpful in order to determine the need to take a license by the assumed patent user and a fair compensation for the patent owner. Firstly, a single procedure can help to determine these aspects on a global scale without the need to opt for a complex multi-jurisdictional litigation. Secondly, it is easier to determine mutually acceptable licensing rates, when an independent third party is involved. In addition, mediators and arbitrators can be selected among specialized experts for each individual case, and therefore may be more specialized than judges and courts.

In order to fully benefit from alternative dispute resolution mechanisms, there should be a broad agreement in the industry to use them instead (for the case of arbitration) or before (in the case of mediation) considering resorting to litigation. These agreements could be a good practice promoted by the regulators, industry organizations or even requested by companies to their providers.

2.13 More visibility to licensing terms

One of the challenges to reach agreements on licensing terms is the scarcity of comparable examples.

Licenses may be determined in different ways, for instance as part of bilateral negotiations or with help of alternative dispute resolution procedures. In these two cases, licensing arrangements are usually private and confidential to the involved parties. In addition, licensing terms can be determined as part of patent infringement lawsuits, in which case awarded damages are usually published and act as a reference for similar licenses in the future. However, most of the patent infringement disputes settle (Kesan 2006), as settlement provides some incentives, such as saving time and cutting huge litigation

[4] http://www.wipo.int/amc/en/center/advantages.html

expenses, or preventing litigated patents being invalidated as part of associated nullity actions. Moreover, as opposed to the sentences, settlement arrangements are generally confidential to the parties reaching the agreement.

Patent pools are another source of licensing rate information. However, it may be argued that licensing rates in patent pools are not necessarily comparable to bilateral licenses for different reasons. For instance, Gilbert (2002) describes that patent pools can be used to protect from challenges to the validity of patents of dubious strength. On the other hand, it is broadly accepted that patent pools are a way to reduce transaction costs, in comparison with bilateral negotiations or litigation.

Taking into account the previous points it is clear that the terms of most licensing agreements are confidential and thus cannot be used as the basis or reference of future agreements. Moreover, every single technology licensing arrangement is unique and not always is straightforward to extrapolate conditions from one deal to another.

Given this complexity, having as many published licensing terms as possible would be a facilitator for determining licensing terms in subsequent negotiation. In order to achieve it, it is recommended that companies agree on this as good practice. Nevertheless, this practice is unlikely to be taken by individual companies, as it may undermine their bargaining power. Therefore, a better approach may be seeking industry-wide agreements or initiatives by regulators and/or legislators to favor this kind of behaviors.

2.14 Supporting defensive patent aggregators

According to policy makers, defensive patent aggregation is under supplied by market forces requiring public support and coordination (OECD 2013). In addition, it is argued that publicly controlled funds can more credibly constrain in pursuing aggressive patent assertion behaviors.

However, publicly-backed funds have also drawbacks. First, constraints on patent assertion strategies are difficult to define and to implement in practice, especially if the aggregators are operated at arm's length. Second, the intervention of the funds may raise the prices for patents without necessarily increasing inventive activities. Third, the competition effects of public patent funds are difficult to predict, as they will depend on their precise implementation and the composition of their patent portfolio. Fourth, adverse selection and moral hazard are common problems both to private and public patent funds. Especially, in the case of the latter, the acquisition criteria need to be more specific and transparent for accountability purposes. However, the perception of market failure appears to be stronger outside the United States, where most private funds operate from and where patents markets appear to be most developed.

The goal of supporting defensive patent aggregators is to generate added value for both the licensees, i.e. lowering fees for licensing in patents in bundles, and the patent owners, i.e. improving the access to markets and increasing revenues from licensing. Some governments, especially in France, South Korea, Japan and Taiwan, have contributed

financially to the creation of private-public entities, either directly, or through state-owned banks, which fund the acquisition of patents from national research organizations. The acquired patents are then typically bundled into clusters and licensed out.

One prominent example of a successful defensive fund is the US-based Open Invention Network (OIN), which is not publicly supported. OIN is a shared defensive patent pool with the mission to protect Linux, a free computer operating system, and related technologies. Any company, project or developer that is working on Linux, GNU, Android or any other Linux-related software can join OIN free of charge or royalties. Its mission is "to safeguard developers, distributors and users from organizations that would leverage intellectual property to hinder its growth and innovation". It does so by acquiring and sharing patents to promote a collaborative Linux ecosystem. On the one hand, OIN cross licenses the patent portfolios of OIN community members for a well-defined, domain-specific field of use that includes key open source technologies. On the other hand, it provides a royalty-free license to its strategic IP portfolio.

Despite the theoretical arguments justifying a public support of defensive patent aggregators, the success of the few existing public initiatives is limited. In contrast, there is a proof that privately initiated, market driven programmes like OIN can be very successful. Consequently, it remains ambivalent whether public support initiatives are effective in remedying possible market failures.

2.15 Insuring patent portfolios

The ability to enforce rights is essential for patents to keep its value, but many companies, especially SMEs, do not have the necessary financial or legal means. Litigation insurance, if it was available for patents, would allow for the sharing of the financial burden and risks associated with patent litigation. Such insurance schemes would help especially innovative companies to manage more effectively the costs and potential financial risk of litigation. It would also provide better negotiation power within patent disputes increasing the likelihood of innovative companies obtaining more favorable settlements.

However, the market for insurance products for been too limited in the EU Member States. In the majority of the Member States, such insurance schemes do not exist or are unknown. Publicly supported insurance schemes do in general not exist. An exception is, on the one hand, the UK, where there is the opportunity to obtain insurance policies to cover the insured entity against its own legal costs and/or the legal costs of someone the entity is in dispute with. Within a programme providing innovation, vouchers may be also used to purchase insurance. On the other hand, in Denmark, the patent office supports the emergence of patent insurance products. However, initiatives to support the availability and access to insurance products on patents and other IPR did not take off in France due to lack of demand.

Consequently, the European Commission (2016) is currently supporting insurance companies to enter the market for litigation insurances and assisting innovative SMEs to access such services.

In contrast, the RPX Corporation (http://www.rpxcorp.com) is obviously providing successfully patent risk solutions in the US. Pointing to the risk of patent troll or NPE (non-practicing entity) litigation, RPX is buying patents to prevent especially this type of litigation. Hagiu and Yoffie (2013) characterize them as defensive aggregators and argue that in contrast to traditional insurance companies, which become active when accidents, RPX gets paid to reduce the probability of accidents, i.e. lawsuits.

2.16 TRADE SECRETS

A baseline option of companies trying to protect their inventions is to keep them secret. Despite their economic relevance, and in particular their role in protecting returns from innovation, trade secrets[5] are rarely studied, because of the missing empirical evidence in contrast to the publicly available information about patent applications. However, the recently released Trade Secrets Directive (European Union 2016), which is trying to harmonize the legal frameworks in the EU Member States, increased the attention on this basic instrument.

In theory, patenting and secrecy is treated as substitutes. In practice, both protection methods are used simultaneously and in a complementary manner not only for different innovations at the firm level. However, firms may also choose to apply both strategies at the level of individual innovations by protecting some elements of a technology through patents and keeping others secret. In general, innovations involve both codified and tacit knowledge. Consequently, firms may apply patents for the codified knowledge and try to keep the tacit knowledge secret. Even, keeping the codified part of an invention secret and deciding about patenting later might be an option.

The complementary roles of the two protection methods are recently confirmed based on the large scale data base (EUIPO 2017). However, the use of trade secrets for protecting innovations is higher than the of use patents by most types of companies and in most economic sectors. The combination is likely to be used by companies with internal R&D, with high innovation expenditure and when the innovation is new to the market.

Considering the sectorial level, manufacturers of computer, electronic and optical products is both patents and secrecy more intensively. Trade secrets are the preferred instrument if

[55] An internationally agreed definition of trade secrecy can already be found in Article 39 of the TRIPS Agreement (Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994).
This definition is also used in Article 2 of the recently adopted EU directive on the protection of trade secrets6:
(1) 'trade secret' means information which meets all of the following requirements:
(a) is secret in the sense that it is not, as a body or in the precise configuration and assembly of its components, generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question;
(b) has commercial value because it is secret;
(c) has been subject to reasonable steps under the circumstances, by the person lawfully in control of the information, to keep it secret.
Trade secrets are not registered and the duration of their protection is not limited to a set term as is usually the case with patents and other intellectual property rights.

the innovations are new only to the firm. As expected, patents are more likely to be used, when the innovative product is a physical good rather than a service. In contrast, companies active in computer programming, consultancy and related activities are strongly focusing on trade secrets and are less considering patents.

In summary, trade secrets are an important protection instrument complementary to patents in ICT-related technologies. However, the complementary role is less prominent for companies in the software and ICT consultancy business, for which trade secrets are significantly more important.

3 EXTRAPOLATING THE OPEN SOURCE PARADIGM TO PATENTS

The open source software has a good level of maturity and has proven useful to create rich ecosystems, which have generated wealth for many involved companies and progress and welfare for the society. Of course, there is room for open source software but also for proprietary software. Both worlds have proven compatible and each has its own reach.

In the realm of inventions and patents, there are initiatives similar to OSS, for instance, different sort of patent pledges by which the patent holders give up some of the rights linked to their patents. However, they are far beyond OSS in terms of reliability, recognition by the industry and success. These tools have a protection function to some ecosystems (e.g. Open Invention Network for Linux) but as opposed to OSS, they have not been so far the basis on which successful ecosystems are created. There may be different reasons for that. Firstly, the asset resulting from OSS projects and been handed over to the community is software, which can be an end product itself or a building block for an end product involving other assets (hardware, other software components, etc.). On the contrary, patents are recipes, and thus having a license over a patent does not save the work to implement or build the technology, unless provided together with other assets (like software). Also, patents are assets that require substantial investment to register, prosecute and maintain, whereas software copyright does not need formal registration and, if done, it is comparably cheap. Therefore, just a minority of companies take the effort to file patents to later waive some of the associated rights. Instead, many companies do not file the patent in the first place if they do not intend to assert them. Another reason is the lack of a normalized set of well-known proofed licenses, as opposed to the case of OSS, where a few licenses cope the vast majority of the OSS projects. One last identified potential reason is the fact that it is easier to identify who owns the copyright over a code than to identify who owns the Intellectual Property Rights associated with a specific technology or product. In the latter case, it may be bound to many patents from different players, which may not have directly participated in the definition of the technology or the creation of the product.

3.1 OPEN SOURCE LICENSES AND MAPPING TO PATENTS

This section analyses different characteristics of Free and Open Source Software, and considers whether there is an equivalent in the field of patented inventions. If there is no equivalence or there is some gap, an indication is made as to how this gap could be overcome.

Free / Open Source Software characteristic	Impact in collaborative innovation and societal welfare	Mapping to patent system	Fulfilment by patent system	Filing the gap
Free Software Foundation's Definition				
Freedom to Run (Use)	Improves societal welfare by allowing any interested party to benefit from the technology.	Right to practice the invention	Any third party is excluded from implementing and using the patent unless it has explicit permission from patent holder (license) or the patent holder has proactively made a non-assertion pledge.	A similar model to OSS in the patent system would require reliable licenses by which patent holders allow the practice of patented inventions.
Freedom to Study	Facilitates an actual diffusion of knowledge, by allowing not just using a software but also understanding how it works.	Patents as a source of knowledge, providing enough information to allow implementing the invention.	It is one of the pillars of the patent system. However, patents are not always educational in practice, but instead, use obscure language and try to be as generic as possible.	Patent offices would be required to ensure that each patent is implementable by the sheer analysis of the patent document, as a requisite for granting the patent.

Freedom to Redistribute	The society benefits from a wider diffusion of knowledge (the software) by allowing any recipient of the software to redistribute it to any third party.	(interpretation 1) Redistribute patent document (interpretation 2) Redistribute (sale) product implementing the patented invention	(interpretation 1) Fulfilled by default: Patents are published usually 18 months after filing unless the patent holder wants to withdraw the application without publishing it. (interpretation 2) Any third party is excluded from selling products implementing the patent unless it has explicit permission from patent holder (license) or the patent holder has proactively made a non-assertion pledge	(interpretation 1) Early publication of patent applications should be allowed and fostered. (interpretation 2) A similar model to OSS in the patent system would require reliable licenses by which patent holders allow the sale of products implementing the patented inventions.
Freedom to Improve	OSS users do not need to start new development from scratch but can rely on the OSS state-of-the-art.	Subsequent Inventions	Patent law allows to file inventions based on previous ones, but practicing those incremental inventions may require explicit permission of the primary patent's owner	A similar model to OSS in the patent system would require reliable licenses by which patent holders allow the practice of a patent that is the basis of subsequent inventions, therefore not hindering the practice of the latter
Open Source Initiative' Definition (characteristics not already mentioned above)				

Integrity of the Author's Source Code. The author may require modifications to be distributed as "patch files" instead of modifying its original code.	Provides certainty to authors, that modifications by third parties will be not attributed to them, thus removing potential barriers for authors willing to release the source code.	Patent holder's control over own patent applications.	Patent documents cannot be modified by third parties but just by the patent holder. Subsequent inventions are protected by separate patent applications, managed by the corresponding patent holder.	No gap
No Discrimination Against Persons or Groups	Basic for societal fairness.	Patent law and regulation	Patent law and regulation ensures that no entity is discriminated against, as well as patent licensing does not follow anticompetitive practices.	Any patent license should follow the non-discrimination principles.

No Discrimination Against Fields of Endeavor	Ensures that broader application of the software is possible.	Patent law. Patent pledges and private patent licenses.	Patent law does not restrict the application of an invention to any specific field of endeavor, beyond the own limitations of the invention itself. Patent law does limit the patentable subject matter, leaving outside some applications mainly for ethical reasons, either because they should not be subject of an exclusion right but instead remain in the public domain (e.g. methods for treatment of the human body) or because its questioned morality (e.g. human clonation). However, this discrimination is perceived as positive for the societal welfare. Patent pledges and private patent licenses may include clauses that discriminate the application of the invention (e.g. just for research purposes).	Patent licenses following the principles of OSS licenses should not discriminate against fields of endeavor.

Distribution of License. The rights apply to all to whom the program is redistributed without the need for execution of an additional license.	Ensures a broader distribution of the benefits of the license, removing the burden to explicitly sign a license agreement.	Patent pledges waiving rights without the need to sign any agreement.	Patent law does not provide any automatic right to third parties, but on the contrary, excludes by default from practicing the invention. Patent pledges could be the closest equivalent of OSS licenses, but they present some gaps (reliability and the lack of well-known proofed and established licenses)	Reliable, well-known and proofed patent pledges / licenses should be defined, with them applying without the need of explicitly executing the license.
License Must Not Be Specific to a Product	Ensures that broader application of the software is possible.	Patent pledges and private patent licenses.	Patent pledges and private patent licenses may include clauses that discriminate the application of the invention (e.g. just for research purposes or for use in a specific product)	Patent licenses following the principles of OSS licenses should not be specific to a product.
License must not place restrictions on other software that is distributed along with the licensed software	Removes a potential barrier for parties willing to release open source code.	Patent pledges and private patent licenses.	Private patent licenses may include whatever type of clauses, although clauses with limitations to other products distributed alongside the licensed one are not usual.	Patent licenses following the principles of OSS licenses should not place restrictions on other products distributed alongside the licensed one.

License Must Be Technology-Neutral. This is aimed at licenses which require an explicit gesture of assent in order to establish a contract between licensor and licensee (e.g."click-wrap")	Ensures a broader distribution of the software, not limiting the technology used for distribution of the software (e.g. FTP).	N/A	N/A	N/A
Legal Basis				
Copyright ownership	OSS licenses may include obligations for the recipient of the software (licensee) so that the spirit of the license is honored. The rights granted by the copyright law can ensure adherence of OSS users to the principles of the license.	Patent ownership	The right to exclude granted by the patent law to the patent holder can ensure adherence to the principles of a patent license	No gap. In fact, Patent rights are perceived as stronger than copyright.
Clauses in specific OSS licenses				

Explicit patent license granted by contributors (For instance in GPLv3 or Apache 2.0), and also for redistributors (GPLv3)	Provides legal certainty to licensees that contributors will not assert the related patents.	Non-assertion covenants (e.g. as per IPR policy of royalty-free SDOs), or explicit licenses granted in patent pledges.	Patent law does not provide any automatic right to third parties, but on the contrary, excludes by default from practicing the invention. Certain types of patent pledges (e.g. non-assertion covenants) could be the equivalent of open source, but they present some gaps (reliability and the lack of well-known proofed and established licenses)	Reliable, well-known and proofed patent licenses should be defined.

Defensive Termination upon litigation, preventing patent litigation initiated by licensees. (For instance, Apache 2.0 license terminates any granted patent license to any party instituting patent litigation for infringement by the licensed work)	Reduces the risks due to infringement of third party patents.	Patent pledges create a safe ecosystem by preventing litigation in a specific realm: Open Innovation Network[6] (protecting Linux ecosystem), Defensive Patent Licenses (avoiding litigation between participants)	Initiatives in the patent realm are non-normalized and independent from each other. For instance, Open Innovation Network may be seen a comparable example, however, it is restricted to the protection of Linux, and the model has not been extrapolated to other fields. On the other hand, the Defensive Patent License limits litigation between participants with regards to any field, not allowing the project-by-project granularity of OSS licenses.	A set of normalized patent pledge licenses should be defined, limiting the patent infringement litigation initiation by any licensee, on a granular basis (e.g. per project or product)

[6] http://www.openinventionnetwork.com

License advertisement in the source code files (file header and/or specific LICENSE file) or when running the code. (For instance, Apache 2.0 requires recipients of the work or derivative works to receive a copy of the license)	This notice ensures that every recipient or user of the software is aware of their rights and obligations	"License of right" indication in some patent offices indicating the willingness to license the patent. Patent pledges usually communicated by means of unofficial media (blogs, web pages, press releases, etc.)	With the exception of the "License of right" indication in some patent offices, the patent record does not include information on explicit rights waived by the patent holder, nor is there an alternative official patent pledge register. It is not a common practice to include such information together with a product either (at most information that the product implements patented technology)	Mirroring the OSS case could be done by means of a more explicit indication of licensing terms (e.g. mentioning a specific license or a set of waived rights) in the patent record. Additionally, or alternatively creating an official patent pledge register. Considering including an indication linked to products implementing the invention, whenever the patent holder has waived some rights.
Attribution (For instance, GPLv3 requires keeping copyright notices upon distribution)	Provides certainty to authors, that their work will be attributed to them and facilitates them to prove copyright over the code, thus removing potential barriers for authors willing to release the source code.	Patent inventors and owner	Patents are published including the name of the inventors and its owner.	No Gap

Virality, that is, redistribution of the work or modified work must be done under the same license (copyleft licenses, such as GPLv3 and the whole GPL license family)	Ensures that modified versions of the work remain in the public domain according to the same principles.	Some patent pledges (e.g. Open Invention Network, Defensive Patent Licenses, or IPR policy applying to contributors to royalty-free standards) can be the most similar cases in the patent realm, as they create a community in which all different parties make the same commitments.	Some patent pledges have a similar effect but as they are non-normalized, there is no well-recognized and proofed license to use, as in the case of OSS, with the GPL license family. .	A normalized patent pledge with viral effect should be defined.
Permissive licenses allowing to use the technology without many obligations to the licensee (for instance MIT, BSD 2-clause licenses just require keeping the copyright notice.)	Provides full liberty to licensees, allowing the reuse of the code even for proprietary products. These licenses allow a broader re-use of the technology at the expense of not requiring licensees to release the code of modified works.	Some patent pledges, such as the non-assertion covenants, with no obligation on those benefiting from it.	Some patent pledges have a similar effect but as they are non-normalized, there is no well-recognized and proofed license to use, as in the case of OSS permissive licenses.	A normalized permissive patent pledge should be defined.

Avoiding anti-circumvention of protection measures, e.g. DRM. (For instance, GPLv3 protects user from protection measures, avoiding them in licensed software and giving users the rights to circumvent them if existing)	This type of clauses avoid tricks used by some companies that release code as open source but implementing some measures that avoid modified versions to properly work.	N/A	N/A	N/A
License Management				

Principles that OSS licenses should comply with, determined by a non-profit, independent entity, Open Source Initiative (OSI) for open source, and Free software Foundation (FSF) for Free Software and GPL licenses. OSI also rubberstamps the conformance of specific licenses to OSS principles, and publish the list of conformant licenses	Ensure that licenses are trustable, consistent and fulfilling a set of principles. In some cases (e.g. FSF with GPL license) take care of the evolution of licenses to overcome detected issues.	Some organizations deal with specific patent licenses or non-assertion ecosystems (e.g. Open Innovation Network for Linux; SDOs ruled by royalty-free policies, etc.)	There is no organization dealing with patent pledges in general, but just specific organizations dealing with portions of the overall ecosystem.	An independent non-profit organization would need to be created to define the principles of patent pledges, and a set of normalized licenses and /or to rubberstamp those licenses that adhere to the defined principles.

3.2 CREATIVE COMMONS LICENSES AND MAPPING TO PATENTS

In parallel to OSS, other initiatives allow the owners of copyright over non-software material (e.g. text, pictures, etc.) to waive some of the associated rights. The most famous is the Creative Commons[7] initiative, which fosters free sharing of copyright protected material as an

[7] https://creativecommons.org/

alternative to the default “all rights reserved” model. The following table analyses the characteristics of Creative Commons, and figures out whether there is an equivalent in the field of patented inventions. If there is no equivalence or there is some gap, an indication is made as to how this gap could be overcome.

Creative Commons characteristic	**Impact in collaborative innovation and societal welfare**	**Mapping to patent system**	**Fulfilment by patent system**	**Filing the gap**
Freedom to use the work itself.	Improves societal welfare by allowing any interested party to benefit from the work.	Right to practice the invention	Any third party is excluded from implementing and using the patent unless it has explicit permission from patent holder (license) or the patent holder has proactively made a non-assertion pledge.	A similar model to CC in the patent system would require reliable licenses by which patent holders allow the use of the patented inventions.

Freedom to use the information in the work for any purpose.	Improves societal welfare by allowing any interested party to benefit from the work, and to learn from examining its details and eventually reverse-engineering it.	Right to analyze the details of the invention and use the information for any purpose	Patent documents are public but may be subject to copyright in certain legislations. Regarding the technical content, any third party is excluded from implementing and using the patent, unless it has explicit permission from patent holder (license) or the patent holder has proactively made a non-assertion pledge. Technical information in patent documents may be subject to other previous patent rights. Reverse engineering of any physical product (even those protected by patents) is not forbidden in general, although patent documents should ideally be self-explanatory in order to allow the implementation of the invention from it.	A similar model to CC in the patent system would require changing those legislations in which patent applications are subject to copyright. In addition, reliable licenses would be required by which patent holders allow the use of the patented inventions, ideally licenses that create ecosystems that foster the licensing of subsequent patents on similar terms.
Freedom to share copies of the work for any purpose.	Improves societal welfare by allowing any interested party to benefits from the work.	Right to practice the invention	Any third party is excluded from implementing and using the patent unless it has explicit permission from patent holder (license) or the patent holder has proactively made a non-assertion pledge.	A similar model to CC in the patent system would require reliable licenses by which patent holders allow the use of the patented inventions.

Freedom to make and share remixes and other derivatives for any purpose.	Improves societal welfare by allowing the creation of additional works based on the original one.	Subsequent inventions	Any third party is allowed to create subsequent inventions based on a patent and to protect them by means of patents. However practicing those subsequent inventions may require permission of the owner of the original patent	A similar model to CC in the patent system would require reliable licenses by which patent holders allow the use of the patented inventions and that foster the licensing of subsequent patents on similar terms.
Attribution. Obligation to provide attribution of the original work upon redistribution	Provides certainty to authors, that their work will be attributed to them and facilitates them to prove copyright over the material, thus removing potential barriers for authors willing to release material.	Patent inventors and owner	Patents are published including the name of the inventors and its owner. Patent documents are required to cite patents on which they are based, so attribution is kept even in subsequent inventions.	No Gap

Share alike. Option to limit previous freedoms by requiring derivative works to be shared using the same license	Ensures that modified versions of the work remain in the public domain according to the same principles.	Some patent pledges (e.g. Open Invention Network, Defensive Patent Licenses, or IPR policy applying to contributors to royalty-free standards) can be the most similar cases in the patent realm, as they create a community in which all different parties make the same commitments.	Some patent pledges have a similar effect but as they are non-normalized, there is no well-recognized and proofed license to use, as in the case of CC Share Alike licenses.	A normalized patent pledge with viral effect should be defined.
Option to allow or forbid distribution of derivative works. (The latter case limits the previous freedoms)	Provides flexibility to authors, thus removing potential barriers for authors willing to waive certain rights but not allowing derivative works	Private patent licenses or patent pledges.	Private patent licenses or patent pledges may include clauses limiting the rights over subsequent inventions.	Patent licenses following the CC principles should allow the option to limit the rights over subsequent inventions
Option to allow or forbid commercial use of the material or modified versions. (The latter case limits the previous freedoms)	Provides flexibility to authors, thus removing potential barriers for authors willing to waive certain rights but not for commercial purposes	Private patent licenses or patent pledges.	Private patent licenses or patent pledges may include clauses that discriminate the application of the invention (e.g. not for commercial purposes).	Normalized patent licenses should consider both cases: allowing or forbidding the commercial use of the invention.

3.3 PATENT LICENSING FRAMEWORK FOLLOWING OSS MODEL

This section depicts a Patent Licensing Framework following the principles and characteristics of OSS and Creative Commons. It describes general clauses that every license, following these principles should include, as well as the differential aspects that may differentiate the different licenses. Also, a managing framework for the licenses is described.

3.3.1 General Assumptions

- Licenses will not discriminate against persons or groups, nor against fields of endeavor.
- Licenses will not require explicit acceptance from licensees.
- Licenses will be universal, not limited for instance to a specific product. Note that patents are meant to be licensed on an individual basis, so this assumption is not related to a need to license all the members of a patent family.

3.3.2 General Clauses

- Right to Practice a patent. It may be an explicit license or a non-assertion covenant. The commitment must be universal, that is, available to any interested party.
- Defensive Termination upon litigation. The license automatically terminates upon the licensee (or affiliate) initiating patent litigation against the licensor (or affiliate).
- License Advertisement: The distributor of a product or service that benefits from the license must advertise the fact to the recipients of the product or service.

3.3.3 Optional Clauses

Each specific license will choose one of the following options:

- Viral: Someone distributing a product infringing a licensed patent must license any other patent it has right to practice that is implemented in said product and are valid in the places where distributor wants to benefit from the license.
- Permissive: No obligation with regards to licensing patents on the recipients of the license or distributor of a product infringing a licensed patent.

Each specific license will choose whether it is restricted to non-commercial use or no such restriction applies

Each specific license will choose whether it allows recipients to own exclusive patent rights over subsequent inventions based on the licensed patent. A limitation in this regard may be in the form of not allowing filing such patents or alternatively mandating those subsequent patents to be licensed following the same or less restrictive license.

3.4 SOCIETAL IMPLICATIONS OF EXTRAPOLATING THE OSS PARADIGM TO ICT PATENTS

This section explores a scenario in which a paradigm equivalent to Open Source Software in the realm of ICT patents becomes a reality, not at a minor scale but with significant impact. It is relevant to measure the plausibility of this scenario, by looking at the incentives the different parties may have, as well as to assess the impact it would have on the society.

3.4.1 Incentives and Plausibility

The open source software movement is not new, but on the contrary, it was born back in the 1980' and thus has a background of over 30 years. Over these decades, OSS has proven not to be an anecdote but a real option, and plenty of organizations and individuals have found incentives to contribute to open source projects and/or to use products based on them. These incentives are economic, utilitarian and/or reputational, depending on the case. That is, some companies have proven to be able to build sustainable and profitable business models around open source software, for instance, by selling professional services related to free OSS products. Moreover, communities of individuals have been interested in developing OSS projects without a direct economic return but instead intangible rewards such as personal satisfaction, improved professional reputation or the benefit derived from the use of an OSS-based product that has been adapted to the needs of the contributor.

The open source software relies on two basic tools, firstly an intellectual property right, the copyright, and secondly a variety of licenses that allow the owners of the copyright to give up part of the legal rights that it confers, under certain conditions.

In parallel, similar initiatives in the realm of patents, i.e. the patent pledges (Contreras, 2015, Contreras 2017), have been put in place over the last years. Patent pledges can be seen as the analogy of OSS to the extend that they rely on an Intellectual Property Right and by voluntarily giving up some of their rights conferred they facilitate the access to the technology to third parties in more convenient terms, or even for free, provided that certain rules are followed. Nevertheless, the impact of patent pledges may not have been as huge as in the case of OSS, and many of these initiatives have ended up losing heart, perhaps with the sole exception of the FRAND commitments required by Standard Development Organizations, which although subject to be further improved remain a widely used and well regarded tool.

In order to figure out the reasons for the differences between OSS licenses and patent pledges, it is important to analyze the grounds on which both tools are built. In fact, the intellectual property right on which patent pledges are based is the patent, which is different in many aspects to copyright. As opposed to copyright, which arises by the sheer creation process and does not requires a formal registration, patents need to be applied for. Moreover, the process to get the right granted demands significant resources, efforts and time, and there is no success guarantee. In order to have meaningful chances of getting a patent granted it is necessary to count with the help of a professional agent who drafts and files the patent application. Apart from the agent's fees, the patent offices impose certain fees for the filing and subsequent processes during the patent prosecution.

Taking previous points into account the entry barrier to file patents for later pledging part of the rights is much higher than in the case of copyright. In fact, individuals will hardly enter into such arrangements. It is not the same to devote some efforts to develop a piece of software and, without any additional monetary investment, revert it to the community, than to invest resources in filing a patent in order to later give up some of the rights associated to it. An individual that is interested in making an invention available to the community would most probably publish it, making it part of the public domain, and avoiding third parties to patent it if they ever come up with the same invention.

The scenario is different for enterprises, as they can obtain benefits by pledging patents that outweigh the resources invested in filing a patent. These benefits may be of several types. Firstly, companies pledging patents get a reward in terms of image. For instance, the "Eco-patent Commons"[8] wass an initiative, recently discontinued, aimed to facilitate the use of existing innovation that is protective of the environment, by which the companies joining the initiative providing the right to practice free of charge some/all of their environment-friendly patents to members and non-members. Beyond the direct benefit the member companies obtain by gaining access to other members' inventions, the initiative provides an unquestionable benefit in term of image and reputation.

Other initiatives may be aimed at creating an ecosystem or making it flourish, seeking indirectly an economic benefit or a better strategic positioning for a company. For instance Tesla, the electric car manufacturer, pledged all its patents in 2014[9], stating that "Tesla will not initiate patent lawsuits against anyone who, in good faith, wants to use our technology". This was interpreted as a move to foster their view and technological implementation of the electric car and thus gaining positive network economies, for instance by facilitating the creation of a network of charging stations, fundamental for their business to succeed in addition of economies of scale achieved by entering mass production.

An example in the ICT sector of a joint patent pledge by a myriad of companies to protect an ecosystem is the Open Invention Network (OIN)[10], a shared defensive patent pool with the mission to protect Linux, GNU, Android or any other Linux-related software. Plenty of companies promote by means of this initiative a stable and trustable framework in which developers continue to develop software on these platforms and users continue to use it. This has an unquestionable positive impact in the business of these companies.

An example of defensive patent pledge is the LOT Agreement[11], by which more than hundred companies commit to grant irrevocable licenses to the other members whenever they transfer a patent to a Patent Assertion Entity, thus providing protection against the practices of these entities. Thus the LOT is an example of patent pledge whereby participating companies get a clear defensive value. As of the date of writing these network

[8] http://www.corporateecoforum.com/welcome-to-the-eco-patent-commons/ (last visited March 14th, 2018)
[9] https://www.tesla.com/blog/all-our-patent-are-belong-you (last visited March 14th, 2018)
[10] http://www.openinventionnetwork.com/ (last visited March 19th, 2018)
[11] https://www.google.com/patents/licensing/lot/ (last visited March 23rd, 2018)

gathers over 800.000 patent rights. LOT Network requires the payment of an annual fee, proportional to the revenues, providing free membership to small companies and start-ups.

It can be noted that the advantages obtained by patent pledges could in most cases not be obtained by just making the technology available in the public domain, as the patent rights provide the power to counteract patent rights from third parties opposing the aims of the patent pledges.

Now looking at the licensee side, in the case of OSS the software is an asset that can be reused with relatively low effort. Therefore, it can be affirmed that the asset that is provided to the community is easy to consume. On the contrary, patents remain more abstract. Getting the right to use an invention protected by patents do not reduce drastically the effort to implement it. The patent can be seen as a recipe, but the beneficiary of a patent pledge still need to "cook" the technology following that recipe, and thus there is still a significant barrier for the consumption of the technology by the community, that may account with part of the responsibility of patent pledges being not as widespread and successful as OSS.

As a summary, patent pledges, as the equivalent to open source software in the realm of utility inventions, is not something workable for individuals, but it is a good option for companies under certain circumstances and with some specific objectives. As it happens in the case of open source software, patent pledges are not a panacea, and their application is not mainstream but limited to just a limited set of circumstances.

One of the main impediments for a wider use of patent pledges is the absence of well-known and proven licenses that provide confidence to the user / implementer about the legal rights conferred by the license. This is one of the differential aspects with regards to open source software, where a set of licenses are broadly known and accepted. In fact, one of most common ways to perform a patent pledge is as part of an open source software license. Therefore, probably one of the most relevant pending issues to make patent pledges as popular as open source software is the normalization of a set of licenses.

Another relevant aspect to highlight is the fact that patent pledges should remain a voluntary decision by the patent owners in order to resemble their counterpart in the software arena, the open source software licenses. Other type of actions to limit the rights conferred by a patent in the current status quo, e.g. reducing patents' lifespan or forcing a License-of-Right, is not to be considered as an equivalent of the open source software model.

3.4.2 Positive effects on social welfare

This section describes the eventual positive effects that could derive from a popularization of patent pledges and its perfection as a legal tool.

The most immediate benefit would be the improvement of social welfare by a wider diffusion of knowledge and technologies. Having free access to invention by others, not only more companies/entities would be able to implement them in their product/services, but

also the increased offer and the lack of royalties would facilitate the offer of cheaper products/services.

Moreover, the free access to patented technology would have an additional positive impact, namely the opportunity to unleash the creation of incentives to create subsequent innovations that would not be restricted by the exclusionary effect of the primary patent, but could be exploited by the creator of the subsequent invention. This could create a virtuous circle, in which more inventions are created and more advance technology is made available to the society. This effect would be even more relevant if the patent pledge requires some sort of reciprocity, that is, requires subsequent patents to be pledged on similar terms, as a prerequisite to benefit from the patent pledge made by the owner of the primary patent. This type of pledges, similarly to copyleft open source software licenses, would ensure that modified versions of the work remain in the public domain according to the same principles.

On the other hand, multilateral patent pledges, that is those that are not performed by a single entity but by a set of actors create a safe ecosystem by preventing litigation in a specific realm. This type of pledges make the patented technology freely available to the other entities taking part in the pledge or in some cases even to any other party that complies with certain rules.

3.4.3 Negative effects on social welfare

A scenario in which patent rights are devaluated to certain extent could cause companies to reduce their efforts in innovation, due to the increased troubles to get a proper return on it, and/or to give priority to trade secret over patenting.

The scenario we are analysing is though different, as it reflects a voluntary decision by certain entities to go for a patent pledge, as opposed to fully exercising the exclusionary right of patents. Even under this assumption some secondary negative effects may arise, although it magnitude would be much lower than in case of a forced and universal devaluation of patent rights. For instance, in a technological realm in which patent pledges become mainstream, and most actors provide free access to their patents, the incentive to produce a huge number of patents decreases. On the one hand, pledging a core set of patents to act as a defensive asset for the community in front of aggressive players not taking part on the ecosystem, may provide clear benefits to pledging companies. On the other hand, the added value of pledging additional patents drops sharply, and so does the incentive to sustain a certain effort in innovation or to protect innovation by means of costly patents on which no direct return is to be obtained.

In the open source software ecosystem the different players choose to be part of the open ecosystem or on the contrary to develop their software in a closed fashion. This creates a sort of dual market in which companies are aligned in two well differentiated camps, with usually opposed interests. This fact causes some tensions, especially whenever an industry-wide collaboration is required, such as in standards development. In the case of patents, the effect could be similar, with to separate camps, firstly the open ecosystem in which each actors benefits from each other's invention, and secondly closed actors that implement

proprietary products that can remain differential to some extent, but that do not fully benefit from the knowledge shared in the community. It should be noted that a single company may decide to bet to open ecosystems on a certain technological realm, and to proprietary developments in other areas.

3.4.4 Revisiting EPO's Scenarios for the Future

The EPO's report, Scenarios for the Future (EPO, 2007), analysed in 2007 the trends in the patent ecosystems and envisaged four scenarios towards which it could evolve. One of these scenarios, the "Trees of Knowledge" one, is especially relevant to the topic under analysis in this section. That hypothetical scenario depicted a world in which patents have been abolished in most technical fields, mainly as a result of the societal opposition to a system that hinders the access by the society to fundamental innovations, such as critical pharma products, or the implementation of environmental friendly inventions. Instead, sharing information through open source, creative commons, etc. is the norm, and other tools such as trade secrecy are used by businesses to protect innovation. However, the scenario depicted as a side effect the decrease of the innovation activity as a result of the absence of profit expectations.

It must be acknowledge that this scenario written more than 10 years ago, could have been written nowadays. The tensions between societal welfare and the commercial interests remain valid at present-day. Although, the scenario is not considered to be plausible in the next years / decades the key questions raised remain mostly unsolved, namely:

- How can public and private interest in IP be reconciled for the benefit of society?
- How are the ethical and moral dilemmas raised by technology reflected by the patent system?
- Where should the limits to patentability be drawn? By whom?

As a rough framing of those questions, and in line with EPO's prediction, it can be said that the abolishment of patents would very unlikely have an overall positive effort in the societal welfare in the mid-long term, due to its impact in a reduction in the innovation. However, the promotion of patent pledges, especially in sensitive fields, such as those with a direct impact on citizen's lifes (health, environment, etc.), be it by the governments, by the societal pressure, or by other determining aspects, would have a positive effect both in the society and in those entities voluntarily entering in such settlements.

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